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The Analysis of Methods of Instruction in College Algebra and Trigonometry Courses in the Langston University Department of Mathematics

Cristie L. Bostic

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The Edwin P. McCabe Honors Program

Senior Thesis

The Analysis of Methods of Instruction
in College Algebra and Trigonometry Courses
in the Langston University
Department of Mathematics

Cristie L. Bostic

December 1995

Langston University
Langston, Oklahoma

REFERENCE
NOT TO BE TAKEN FROM THIS ROOM

**THE ANALYSIS OF METHODS OF INSTRUCTION IN
COLLEGE ALGEBRA AND TRIGONOMETRY
COURSES IN THE LANGSTON
UNIVERSITY DEPARTMENT OF
MATHEMATICS**

By

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Submitted in partial fulfillment
of the requirements of the
E.P. McCabe Honors Program
Fall 1995

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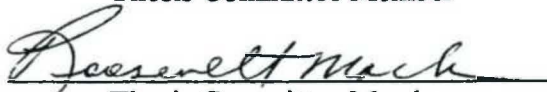
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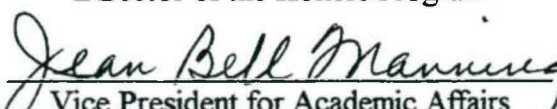

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CHAPTER I

INTRODUCTION

A General Description of the Area of Concern

In 1978, a recurring effort was made to remedy the constant decline of test scores in the area of mathematics around the country (Milhalko, 1978). At this time educational methods of "back-to-basics" and "competency-based" programs were seen as the solutions to the drastic decline in test scores and the decrease in interest among students in mathematics courses. Seventeen years later, teachers of mathematics in both the secondary schools and universities (entry level courses) are confronted daily with students who possess a fear of mathematics, students who are unwilling, uninterested, and unable to learn the concepts in mathematics, and students who possess a combination of these problems.

These negative attitudes about the subject of mathematics have led students to have low grades and in some situations to fail in some or all areas of mathematics. As a result, some researchers assume there will inevitably not be enough capable people interested in careers of science and engineering because these areas require application of mathematical knowledge and concepts. The major concern of mathematics professionals, educators, and society is whether or

not public schools and higher education are taking steps to change the dispositions of the students so that a higher percentage of students understand, appreciate, and use mathematics, which in turn will prepare them for careers requiring the application of knowledge of mathematics.

The answer to this question is complex. A number of articles, books, and papers have been written to identify the crux of the problem and suggest ideas for improving mathematics curricula to meet the needs of students preparing for careers in a technological world.

Problems to be Studied

The educational setting of the problem in this study focuses on college entry level mathematics courses at Langston University, the only historically black college or university (HBCU) in the state of Oklahoma and the only Oklahoma college with both a land grant and urban mission.

Langston University is located in a rural area in North Central Oklahoma and has upper-division centers in Tulsa and Oklahoma City. The problem faced by a large number of students in the Langston University main campus mathematics program is that they fail, drop, and have to retake mathematics classes and that they possess a general dislike for mathematics and apparently are unable to grasp the mathematical concepts taught by teachers at Langston University on the main campus. Most students must struggle to understand in the mathematics courses in which they are enrolled.

Many of the students at Langston University attribute their difficulties in mathematics to a variety of reasons. Some leave Langston University never to return or delay their progress and advancement in their specific educational areas because of their problems in the six hours of mathematics which they must take to meet general education requirements.

The problem of students not being able to interpret and understand or appreciate the concepts of mathematics has become a nationwide problem and seems to be intensifying rather than improving. According to research this problem exists on most university campuses in their mathematic programs.

Purpose of the Research Project

The purpose of this study is threefold. First, this study is proposed to determine whether the success or lack of success of students in College Algebra and Trigonometry (general education) courses at Langston University is the responsibility of the teacher, the student, or both. Second, this study determines the probable cause of the problem that exists in the Langston University Department of Mathematics. Finally, this study proposes a possible solution for the problem that exists for the students enrolled in College Algebra and Trigonometry and for the faculty teaching these classes in the Department of Mathematics of Langston University.

Major Research Questions

Questions to be answered in the study are as follows: 1) Why do some students not have a clear understanding of the basic concepts in College Algebra and Trigonometry according to (a) the students and according to (b) the instructors? 2) Do the college instructors demonstrate a desire to convey mathematical information in the most feasible way for those students who are unwilling or unable to understand the complex ideas of mathematics? 3) What are the most commonly used methods of instruction in College Algebra and Trigonometry courses at Langston University? 4) What measures are being taken to improve the success rate in Langston University's general education mathematics courses (College Algebra and Trigonometry)?

Significance of the Problem and the Justification for Investigating It

Through this study Langston University will be provided with possible solutions to some problems identified in the Langston University mathematics department; determination of the methods of teaching that best fit the needs of College Algebra and Trigonometry students; and insight on what is being done and should be continued to improve the mathematics curriculum at Langston University. The major purpose of this thesis is to be a catalyst for change if needed; through this information, change is a possible outcome.

CHAPTER II

REVIEW OF LITERATURE

According to some professional mathematicians, educators and philosophers the attitude toward learning mathematics has never been positive. One writer states that a specific teacher experienced mathematics as "a collection of rules, rituals, and routines; an arbitrary, unconnected array of procedures" (Corwin, 1993). Another author, Morris Kline (1967), states in his book Mathematics for the Nonmathematician that some noted philosophers consider mathematics as a "damnable" and "useless" subject that does not evoke support from even some major mathematicians. In the book Reshaping School Mathematics published by the Mathematical Sciences Education Board National Research Council (MSEB, 1991), the author explains that mathematics is still understood as "an immutable collection of absolute truths," meaning that currently there are those who view mathematics as an abstract area of study that has no use or relevance to daily living. Although the dispositions held by some in prior decades may be comparable to those held today, the efforts to alter students' attitudes toward mathematics create the difference in society that is

needed to create change for the future. The following quotation supports this idea:

The “goods” of education have been redefined to include more than the basics. Employers and authorities agree that in addition to literacy and numeracy school leavers need presentation, communication, and decision-making skills and the ability to solve problems to participate in team work and to work cooperatively. These are the skills addressed in contemporary mathematics teaching at its best. (10)

This quotation may be true, but it is noted in Robert Frahm's article printed in the March 1991 edition of the Hartford (Connecticut) Courant, that America is still facing a "severe shortage of scientists and engineers by the end of the century." This statement is representative of society's awareness that student interest in mathematics is deteriorating and mathematics teachers' instructional methods are failing.

The statistical information and outlook presented outlines a problem that teachers face daily in their classrooms at a variety of levels (primary to college). That problem is having to teach mathematical skills to a majority of students who are "unwilling" and/or "unable" to learn mathematics (Milhalko, 1970). Therefore, year after year students stumble through the system, some failing—

never passing the classes, others repeating classes and many who do well not considering any careers that require the use or application of mathematical skills. Terry Vatter (1992) identifies the students defined above as "at-risk" students. Vatter's (1992) research determines that the "at-risk" students constitute the "neediest" and largest populations in schools around the country. She makes her statement about "at-risk" students based on her research and the research of many others. This extensive problem of students who are not performing well in school plagues the nation. According to research, students have such negative opinions about mathematics because the number of people with whom they have come in contact who have negative attitudes about the subject of mathematics.

Society is faced with an enormous question: Why do people feel so negatively about mathematics? The literature indicates that adverse attitudes may be created by a variety of factors, the most common being the method of instruction used by mathematics instructors. According to Burton (1994) there are some additional factors that influence negative attitudes: societal influences, school curricula, teacher attitudes, and student activities and achievement-related behaviors. Of these factors, the student activities and achievement-related behaviors and/or establishing the relevance of mathematical content are the second most common factor contributing to negative attitudes of students toward mathematics.

In reference to classroom methodologies, John C. Milhalko (1978) states in his article "The Answers to the Prophets of Doom: Mathematics Teacher Education" that one of the main reasons for failure in the classroom can be attributed to the way mathematics has been taught. This is not a new idea and improvements of teaching methods have been presented as a remedy to the mathematical understanding of students.

Another person who was given the title "Pioneer of Educational Pedagogy," Jacob William Albert Young, was one of the first pedagogical specialists in the area of mathematics and is most commonly known for his instructional handbook The Teaching of Mathematics. Young's ideals were based on the belief that one needs a variety of tools and skills other than mathematics comprehension to be a successful mathematics teacher (Stein, 1993).

During the early 1900's Young conducted studies that explained the limitations of traditional classroom instruction. From this series of explorations, Young found teaching was least productive with lecture or "teacher exposition" as defined in Stein's (1993) article. It was because of this hypothesis that Young suggested common grouping and cooperative work. These activities would provide time for individually paced learning and hands-on experience or a combination of both (Stein, 1993). Young recognized the need for change. Nearly eight decades later the National Council of Teachers of Mathematics wrote the Curriculum and Evaluation Standards for School Mathematics, which

incorporates Young's idea of using various methods of instruction and evaluation to produce effective learning (Ball and Schroeder, 1992). The "Curriculum and Evaluation Standard for School Mathematics" focuses on Young's vision by encouraging mathematical reasoning, problem-solving communications, and connection—all central to Young's idea of what composes mathematical pedagogy.

In Young's opinion, the use of the various methods mentioned conveys mathematical concepts and provides the arena for other disciplines to be included with mathematics to encourage understanding and provide relevancy to the students. It was this opinion that prompted Young to promote and encourage laboratory teaching, now understood as a constructivist view in teaching. As a specialist in the area of mathematical pedagogy, Young was confident that his opinion of how students interact with and understand mathematical concepts would provide the needed relevance in mathematics for daily living in addition to stimulating the interest needed to keep students motivated to learn (Stein, 1993). This methodology, as well as his other contributions to mathematical pedagogy, focused on student-centered needs and abilities, which, in Young's opinion, was the avenue needed for success.

Based on Young's theory and others, many students at Langston University who are required to take College Algebra and Trigonometry courses have struggled with the instructional methods of some professors. At the college

level the mathematical tasks involve lecturing and assigning homework problems. According to research, a majority of teachers simply teach the way they were taught (Prevost, 1993).

Although pedagogical practices of teachers may be the issue central to the problem, many articles fail to identify the difficulty teachers encounter in restructuring their pedagogical practices. Many recognize that changes are needed for improvement in their mathematics classes but find it "unsettling" and "burdensome" to redesign methods of teaching that, for years, have worked for themselves and others (Prevost, 1993). Fernand Prevost writes,

You profess to believe and subscribe to a set of practices that will help your students to learn mathematics. You have a theory of teaching, which was shaped by the way you were taught...You have been successful....

It is precisely because of that success that change may be difficult. (75)

Because many mathematics teachers find change difficult, it is clearly understood why the suggested "new" methods of teaching mathematics focusing on relevancy are not being implemented. Professional educators feel the "new" methods of teaching are stepping stones to national educational advancements in test scores and student ability to understand and retain mathematical knowledge.

In reference to Professor Milhalko's (1978) essay, a disease has developed among students—and more importantly—teachers. According to Milhalko (1978), the sole responsibility of teachers at the college institutions should be to prepare teachers to teach mathematics using the method of instruction with they are taught to teach the information.

Among other reasons why students experience difficulty when learning mathematics, and the second most prominent problem, is the irrelevance of the material. One author states that "unless a person chooses to pursue his/her education beyond the age of sixteen there is little in secondary mathematics that will be useful later in life" (Burghes, 1989). Because many teachers and professionals are aware of the irrelevance of the mathematics curricula, most educators are making strong efforts to "reshape" mathematics to stimulate interest and learning in classes around the nation. For example, Frahm (1991) reported that the "Professional Standards for Teaching Mathematics" urges teachers to develop mathematical reasoning skills instead of memorizing formulas and to link mathematics to "real-life" applications instead of mechanistic answer-finding.

Lorelei Brush (1980) conducted a study that revealed that the majority of students surveyed did not perceive mathematics as useful. Brush (1980) wrote that most students who see no reason for application of mathematics in their future careers or personal lives are less likely to take optional or advanced

courses in the subject. This problem is considered one of the major factors contributing to negative attitudes about mathematics. According to a number of authors, it is the responsibility of the instructor to convey the relevance of the subject.

In the book Reshaping School Mathematics (MSEC, 1991), the authors note that over the past twenty-five years there have been significant changes in the nature of mathematics and the types and variety of problems to which mathematics is applied. Therefore, one may say that the former abstract concepts of numbers and computation are not the only forms of mathematics but that a variety of mathematical techniques are applicable in the area of mathematics. For this reason, there should not be any excuse for teachers not being able to demonstrate concepts in mathematics that are relevant and useful for students in their educational life or careers.

Although the cause of the problem seems to point solely to the teachers, there is another side to this problem--the students. Despite the fact that a majority of students are "unwilling" to learn, a larger population of students suffer from a fear of mathematics. This fear is referred to as "math anxiety." This handicap as stated by Milhalko (1978) is a problem that plagues prospective teachers as well as students. With math anxiety a person may admit that he/she never really understood mathematics and is convinced no practice or drill will help him or her (Milhalko, 1978). Most math anxiety students memorize

information to make the grade, but once they have reached the college level they find that they are inadequately prepared to apply any concepts in mathematics that they have learned (Milhalko, 1978).

One author writes that at the college level math anxiety is common among students who are required to take mathematics courses as a part of the general education course requirements (Fairbanks, 1992). Fairbanks describes the student's anxiety as a nervousness that becomes powerfully detrimental to performance on a daily basis and especially during examination periods. As for examinations, Fairbanks (1992) identifies that students have difficulty learning and expressing what they have learned on examination. Some authors believe that math anxiety is inherited while others agree that it is created. Nevertheless, any student possessing this phobia is risking academic success when enrolling in any mathematics course. Those authors who believe that math anxiety is created are strongly of the opinion that if "they [the students] believe that they can't do something...students [may be] unable to perform a task of which they are truly capable" (Dodd, 1992). When students and teachers have recognized this inhibiting disease, the next step is finding solutions.

The National Council of Teachers of Mathematics (NCTM) has published two guidelines for mathematics teachers to follow: "Professional Standard for Teaching Mathematics" and its companion "Curriculum and Evaluation Standards for School Mathematics" (Ball and Schroeder, 1992). The second

document focuses on improving curriculum while the first document focuses on teaching. The "Professional Standards for Teaching Mathematics" explains the types of classrooms in which students can encounter, develop, and use mathematical ideas and skills in the context of genuine problems and situations. Also this document outlines the role of the teacher as a facilitator helping students learn to use a variety of resources and tools such as computers, calculators, and concrete and pictorial models. The major goal of this document is to introduce innovative ways of teaching.

The theory of learning known as constructivism involves the idea of having students investigate mathematical concepts so that they may explore ideas for themselves using their own line of questioning and inquiry. Although it requires flexibility, confidence, and a willingness to explore whatever ideas are confronted, it alerts students to the ideas that teachers consider important enough to pursue. One tool in constructive learning is the use of computers and calculators. The book Reshaping School Mathematics (MSEB, 1991) states that although the use of calculators and computers has some liabilities, they are considered effective tools for transforming "typical arithmetic" lessons into "motivated exploration." Computers are more commonly accepted as "effective tools" rather than calculators, but most teachers feel that neither encourages skills and motivates students in a realistic fashion (MSEB, 1991).

Despite these truths, computing devices have

- * Increased the importance of many areas of mathematics that are now rarely taught
- * Focused attention as much on problem formulation as on problem solving
- * Made possible tools for teaching and learning of a sophistication still largely undreamed of by most mathematics educators. (19)

With these new opportunities, teachers of mathematics are given unlimited options to teach to a variety of students who learn in different ways. One teacher, Marilyn Burns (1993), suggests the following steps for becoming a better math teacher:

1. Set the following expectations for your students: Do only what makes sense to you.
2. Have students explain their reasoning in all instances.
3. Encourage children to talk with one another during math class.
4. Make writing an integral part of math learning.
5. Embed math activities in context.
6. Use manipulative materials whenever possible.
7. Make calculators available to all students at all times.
8. Let students push the curriculum rather than having the curriculum push the students.

9. Keep an eye out for instructional activities that are accessible to students with different levels of interest and experience.
10. Remember that confusion and partial understanding are natural to the learning process.
11. Take delight in student thinking.

Besides these steps there are a number of innovative activities and contracts that have been published for teachers to view and implement. With the variety of information that has been made available to mathematics teachers at all levels, success in teaching mathematics courses is possible.

This review of literature points out the most prominent problems in math departments and in math classes around the nation. Likewise, some possible solutions to these problems are introduced. Considering the history of mathematics and how it has been taught and learned, investigating the new methods for change in pedagogy and increasing student understanding must be done in order to make the changes needed to improve mathematics curricula.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study is to determine which factors play a significant role in producing students with a positive attitude and a clear understanding of mathematics in the areas of College Algebra and Trigonometry classes in the Department of Mathematics at Langston University. The assessment of these factors is based on data collected through student questionnaires and teacher interviews. The information that forms the basis for *Student Questionnaire II* (see Appendix) is based on the responses given in *Student Questionnaire I* (see Appendix). The twelve suggestions for improvement in question fifteen and the answers for questions four, seven, nine, ten, twelve and fourteen are results from subjective responses in *Student Questionnaire I*. These answers were chosen based on the most popular responses of the students who completed the first questionnaire.

Population

The student questionnaire was distributed randomly among one hundred students.

Eighty responses were received from the one hundred student questionnaires that were distributed of *Student Questionnaire II*.

Nine teachers constitute the faculty in the mathematics department; of those nine, six instructors were able to participate in the interviews.

Questionnaire and Interview Design

Student Questionnaire

The questionnaire was designed to elicit factors (instructor's methods, background information, student dispositions, etc.,) that contribute to the opinions held about the mathematics department at Langston University. The first two questions ask whether the student is currently enrolled in College Algebra or Trigonometry and how many times the student has been enrolled in these courses. Questions three and four inquire about the background of the students and whether or not their college instructors use a variety of methods to teach their College Algebra and Trigonometry courses. Question five asks the student if the instructor teaches to a specific gender. Question six follows by asking if the student possesses a fear of mathematics. If the student chooses to answer the question yes, three of the most common reasons for mathematics anxiety are listed in question seven. Numbers eight, nine and ten are related questions. Number eight asks if the college instructors demonstrate an interest in all students mastering College Algebra and Trigonometry. If the student

answers number eight with a yes, the student is asked to choose the degree of interest shown by instructors in question nine. If the student does not feel that the instructors demonstrate an interest in the students' mastering the concepts, question ten asks the student to choose the best reason for the teachers' disposition.

Question eleven asks if basic skills have enhanced student success in the area of College Algebra and Trigonometry. Question twelve allows students to choose one reason that explains how basic skills have or have not enhanced their success in College Algebra or Trigonometry.

Questions thirteen and fourteen are another set of related questions. The first question asks if the student makes use of the math laboratory. If the student does not make use of the math laboratory question fourteen asks that the student circle the main reason why he or she does not use the laboratory.

The last question is designed to ask the students to help develop some possible solutions to improve the Langston University Department of Mathematics. If the students believe that the mathematics department is in need of improvement, twelve solutions are suggested in number sixteen; the students are asked to check all of the solutions that apply.

Teacher Interviews

The first question of the teacher interview is geared to the number of methodology courses the teacher has taken prior to teaching mathematics at Langston University. The second question asks if the instructor has had any courses that provided training in the area of computer-assisted instruction. The third and fourth questions ask if the teacher enjoys teaching College Algebra or Trigonometry and if he or she feels these subjects should be included as part of general education requirements. The fifth and sixth questions ask what types of methods are used and which methods are most conducive to learning in the teaching environments. Question seven asks if the students do not understand the content according to the way that it has been presented, what methods are used to reform the instruction. The eighth question asks if the teacher has returned to high school level teaching while teaching at the college level and in what capacities. Questions nine through ten ask about the preparedness of the students entering and attending Langston University. Questions eleven asks for suggestions of improvements for the Langston University mathematics department.

Administration of the Instrument

Approximately forty student questionnaires were randomly distributed in the Langston University student dormitories . Sixty-six of the student

questionnaires were randomly distributed in College Algebra and Trigonometry courses.

The teachers were contacted individually to ask for an appropriate interview time. In some cases, interviews were scheduled, but the instructors were not in their offices. Six instructors were able to meet at the scheduled times or re-scheduled times.

CHAPTER IV

PRESENTATION OF FINDINGS

This study seeks to determine the major factors that contribute to the negative dispositions of a large majority of students who have been enrolled in or are currently enrolled in College Algebra and Trigonometry courses at Langston University. The literature reveals that most students who dislike or do not do well in mathematics mainly do not because of the instructor's methods of teaching and the lack of relevance of mathematical concepts in daily living. This chapter presents the findings based on eighty student questionnaires recorded and six teacher interviews (nine instructors). These questionnaires and interviews were conducted during the spring and fall semesters of 1995.

Student Questionnaire Findings

The survey reveals that a majority (75%) of the students interviewed were currently enrolled in either College Algebra or Trigonometry courses. Seventy-five percent (75%) of these students surveyed were or had been enrolled in College Algebra or Trigonometry one time only. Twenty-four (24%)

percent had enrolled in either College Algebra or Trigonometry two or more times.

Of these students, thirty-eight percent (38%) have a mathematical history that includes Algebra I and II and Geometry only. The second most common high school mathematics curriculum of the students surveyed was Algebra I and II, Geometry, and Trigonometry. This population made up twenty percent (20%) of the total number surveyed.

According to the student surveys a number of teachers in the Langston University Department of Mathematics use a variety of methods in teaching College Algebra and Trigonometry classes. This statement is supported by eighty percent (80%) of the students surveyed. Of those who agree that the teachers in the Langston mathematics department use a variety of methods, their choices are listed below from most common to least common and with respective percentages:

- * 1. Lecture (67%)
- * 2. Homework (53%)
- * 3. Student Participation (56%)
- * 4. Question and Answer (47%)
- * 5. Computer-Assisted (72%)
- * 6. Writing Assignments (journal, papers, etc.) (61%)
- * 7. Hands-on Projects (69%)
- * 8. Audio Visual Material (73%)

As for gender bias, ninety-four percent (94%) believe there is no gender bias in the Langston mathematics department.

Forty percent (40%) state that they do not fear mathematics. Fifty-six percent (56%) represent the number of students who have somewhat of a fear and a definite fear of mathematics. Of those students who possess a moderate to great fear of mathematics, thirty percent of the students attribute their fear of mathematics to a lack of understanding.

Sixty-four percent (64%) of the students say it appears that the instructors show an interest in all students' mastering College Algebra and Trigonometry concepts with 55% percent of these students agreeing that teachers show a great interest in students mastering mathematical concepts. Forty-three percent (43%) agree that the teachers show some interest in students' mastering the concepts.

Thirty-six percent (36%) of the students who said the teacher show no interest in students' mastering the concepts have chosen the following statements as the top two reasons for the instructors' behaviors:

- 1) Instructors focus on completing the syllabus schedule. (41%)
- 2) Instructors cater to students who are comprehending the concepts and other materials and ignore those who are not comprehending. (38%)

The majority of the students agreed that basic mathematical skills enhanced their success in College Algebra and Trigonometry courses. Sixty percent (60%) of the sixty-three persons who answered in the affirmative also agree that basic mathematical skills provided the building blocks they needed to

learn new mathematical concepts. Others believe that basic mathematical skills made learning new concepts simple. Twenty-one percent (21%) said that basic mathematical skills offered no assistance in College Algebra and Trigonometry courses.

Sixty-nine percent (69%) of the students agree that the mathematics laboratory should be used. Of the thirty percent (30%) who do not use the laboratory thirty-seven percent (37%) agree that the main reason for their not using the math laboratory is that the laboratory hours conflict with their schedule.

The majority of the students feel that the instructional strategies can be improved. There are twelve strategies suggested from which students could choose that they feel may contribute to improving the success of students in College Algebra and Trigonometry courses in the Langston University Department of Mathematics. Listed below are the top three improvement revealed by the student questionnaires:

1. Take the time to cover the material (65%)
2. Provide relevant information during instruction to fit the needs of the students. (55%)
3. Employ teachers who teach mathematic courses appropriate for specific majors. (36%).

Teacher Interviews

Most of the teachers interviewed have had methodology courses as part of the general course requirements. Only one was required to have training in mathematical computer-assisted training; three other instructors chose to take training courses in this area.

The majority of the instructors enjoy teaching College Algebra and Trigonometry, but all prefer to teach some higher level courses so that they may stay abreast with their mathematical skills, practice more creative teaching techniques, and “break new [learning] ground.” Three of the six teachers feel that College Algebra and Trigonometry should not be part of the general education requirements because they do not suit the needs of all students. One teacher feels College Algebra and Trigonometry should be included to teach students basic mathematical skills to prevent them from being exploited by others in later in life. Although the other teacher believes that College Algebra and Trigonometry courses should be included in the general education curriculum, one feels that it should be offered and mastered at lower levels. The other teacher feels that College Algebra and Trigonometry may be appropriate for some majors but not necessary for all majors; therefore, this instructor suggests an extension of general education mathematics courses in addition to College Algebra and Trigonometry for specific majors.

Four of the teachers agree that homework is the best instructional technique while two instructors feel that discovery learning and the hands-on experience are the best instructional methods.

All of the teachers said that they modify or use another instructional approach to mathematical concepts when students fail to understand. Some limit the amount of material they cover because they feel much of the material causing students to misunderstand may be covered at a later point or that students have not been present to receive the appropriate information.

The instructors discussed a variety of ways to motivate students. Three of the teachers encourage the students verbally with compliments and other forms of praise. Another teacher relates the historical emphasis of mathematics to daily living and shows its relevance to society. One teacher chooses to find out background information about the student, find out what the student succeeds at, and then encourages the student from that standpoint. Another teacher demonstrates that problems are workable by working the problem without the use of prepared instructional notes. This instructor feels that when spontaneity is used to work a problem on the chalkboard being read for the first time by the instructor, students may develop initiative that makes them feel capable of following the same thought processes the instructor uses to solve a "new" problem.

Three teachers have been back to the high school level since teaching at the college level. One was a teacher at the high school level for six years, another was a visitor as a supervisor of entry-level teachers and student teachers, and the other teacher served as a summer program consultant for an engineering program.

Most of the teachers feel a number of students are prepared to take College Algebra and Trigonometry courses when they come to Langston University, while a number of students are not. Two instructors feel that Langston University students are not prepared at all before enrolling in College Algebra and Trigonometry Courses at Langston University. Most of the teachers feel that some students take the necessary measures in order to succeed in College Algebra and Trigonometry courses while others do not. One instructor states that students feel that the majority of information in College Algebra and Trigonometry courses is prior knowledge; therefore, students do not put as much effort into learning and succeeding in the general education courses.

Last, the teachers stated that among themselves there is much collaboration in working to improve the mathematics department. Some of the departments or academic areas that the Department of Mathematics collaborates with include: Chemistry and Physics, the School of Business, and the former Multimedia. One of the instructors stated that the faculty in the Department of Mathematics has been involved in teaching methodology courses that examine

interdisciplinary programs; more such endeavors are expected. Of these six teachers, a few feel that the curriculum should be adjusted to meet the needs of the students by providing more assistance in the mathematics laboratory and more tutorials on the computers. Others feel that no changes should be made.

CHAPTER V

Summary and Conclusions

Chapter one presents the necessary background information to understand the study and the questions that were sought. Chapter Two provides the detailed background information pertinent to the factors that affect attitudes and academic success of students primarily at the secondary and college levels. Chapter Three provides a description and examples of the research methodology, the questionnaire, and the teacher interviews used in the survey. Chapter Four presents the results obtained from the questionnaire and teacher interviews with the percentage distributions of each in the questionnaire and an explanation of ideas for the teacher interviews.

Why do some students not have a clear understanding of the basic concepts in College Algebra and Trigonometry? According to the questionnaire the teachers do not allow enough time to cover the material so that students can comprehend the new information. Few of the students fear mathematics, but a large percentage of the students have some insecurities about mathematics and attribute their insecurities to their lack of understanding.

It seems as though students are making strong efforts secure their success in the areas of College Algebra and Trigonometry according to the popular use of the mathematics laboratory.

According to teachers the students do not attend class regularly, and most of students do not possess the necessary preparation skills to succeed in College Algebra and Trigonometry courses prior to enrollment in these general education courses.

Do the college instructors demonstrate a desire to convey mathematical information in the most feasible way for those students who are unwilling or unable to understand the complex ideas of mathematics? Yes. According to the statistics, most of the students surveyed agree that the teachers do demonstrate an interest in the students who are mastering the concepts. But the thirty-six percent (36%) of students who feel that the teachers do not demonstrate an interest in the students state that teachers should not focus as strongly on completely the syllabus schedule but rather concentrate on all students' comprehending the material and not a small number of students.

What are the most commonly used methods in College Algebra and Trigonometry courses? According to both students and teachers the most commonly used methods are lecture, homework and student participation. The teachers feel that students at Langston University profit the most from these methods of instruction. According to research, these methods are not highly

suggested as effective instructional tools, but rather the hands-on and discovery learning approaches that allow the instructor to better meet the needs of all learning styles in the classroom.

What measures are being taken to improve the success rate of students in the Langston University mathematics department? According to teachers, the major improvement necessary for Langston University students is tailoring the curriculum to meet more of the students' needs. From the students' point of view there are a number of suggestions.

AVENUES FOR IMPROVEMENT

1. Take time to cover the material. Make sure the students are grasping the concepts before proceeding to other topics.
2. Provide the relevant information during instruction to fit the needs of those students having a difficult time understanding the information.
3. Have more teachers who have had methodology courses.
4. Lengthen the hours of the mathematics lab.
5. Give a variety of active student participation projects to spread the distribution of points.
6. Update computer systems in the mathematics lab.

7. Purchase textbooks that cater to a variety of learning techniques and learning levels.
8. Increase student/teacher conferences.
9. Have tutors for higher level math courses.
10. Have mathematics courses appropriate for specific majors.

Among the factors listed most students feel that the most important factors is the pace at which the teachers go. According to literature most teachers become frustrated when instructing the students who are slower learners. A suggestion by Prevost (1992) is that a teacher should to take time to reflect on his/her learning experience before teaching and reevaluate the way he/she learned and how it was presented.

The results of the survey indicate that some of the students have fears or insecurities about mathematics. If the instructors would take this into consideration by addressing math anxiety and possible solutions that have been identified, then they can remove one stumbling block in the way of student success.

With the consideration of the statistics, facts, suggestions and background literature enough information is presented to provoke change in the Langston University mathematics department. It has been noted that changes are needed; this study provides possible suggestions for improvement.

APPENDIX

STUDENT QUESTIONNAIRE I

Please circle one of the following:

Gender

- A. male
B. female

Student

- A. traditional
B. non-traditional

Race/ethnic group

- A. Caucasian/White B. African-American/Black
C. Asian American D. Latino-Hispanic American
E. Native American
-

Please answer the following questions by circling an answer.

1. In which course are currently enrolled?

A. College Algebra B. Trigonometry C. Neither
2. How many times have you enrolled in either College Algebra or Trigonometry at Langston University?

A. Once B. Twice C. Three or more
3. How far did you go in the mathematics courses that were offered at your high school?

A. Algebra I
B. Algebra I and II
C. Algebra I and II, and Geometry
D. Algebra I and II, Geometry, and Trigonometry
E. Algebra I and II, Geometry, Trigonometry, and Calculus
F. Other: (please specify) _____
4. Does your college instructor use a variety of methods to teach College Algebra and Trigonometry? A. Yes B. No
If yes, please choose one or more of the following.

Computer-assisted Hands-on (projects) Writing assignments
Homework Student participation Lecture

Audio-visual material (hand-outs, music, models, etc.)

Question and Answer (only)

5. Do you feel that your mathematics instructor teaches to a specific gender ?
A. Yes B. No
If so, which? A. Female B. Male

Please answer the following questions with a yes or no, and give a brief explanation.

6. Do you have a fear of mathematics? Why?

7. Does it appear as if the college instructors show an interest in the students mastering the concepts in College Algebra and Trigonometry? If yes or no, please explain briefly.

8. Have basic math skills enhanced your success in the area of College Algebra and Trigonometry? If yes, how? If no, why?

9. Do you take advantage of the math lab? If no, why?

10. If your answer to #9 is yes, are the math tutors in the math lab adequately prepared, and for what areas are they prepared to tutor?

11. Have you ever received outside tutoring in College Algebra or Trigonometry? If so, with whom? If not, why?

12. As a student of Langston University do you see any avenues to improve the instructional strategies of teachers in College Algebra, Trigonometry or other math courses? If yes, what are the possible avenues? If no, why?

Code: _____

INSTRUCTOR INTERVIEWS

GENDER

Male or Female

EDUCATIONAL BACKGROUND

Undergraduate Degree: _____

Master's Degree: _____

Doctoral Degree: _____

The questions that were used to interview the instructor's in the Langston University mathematics department are listed below.

1. Did you have any teaching methodology courses on instructional strategies for teaching mathematics? If so, were they general course requirements of an education major or were they taken as an elective courses that would enhance your teaching methodology?
2. Have you had any training for mathematical computer-assisted student instruction?
3. Do you enjoy teaching College Algebra and/or Trigonometry or you prefer a higher level of mathematics? Please explain why or why not?
4. Do you think College Algebra should be a part of general education course requirements? If so, why? If not, why?
5. What types of teaching methodology do you find most effective when teaching students in the areas of College Algebra and Trigonometry?

6. When you see that the majority of the students may not be mastering a concept do you change your method of instruction? If so, how? If not, why?
7. How do you motivate unwilling students or students with a fear of mathematics students to grasp the concepts?
8. Since you have been teaching mathematics at the college level have you been back to the high school level? If yes, in what capacity?
9. Do you feel the caliber of students at Langston University are as adequately prepared, upon entering Langston University, as students at other colleges and universities?
10. Do you find that the students at Langston University make the necessary preparations, while attending Langston University, to succeed in College Algebra, Trigonometry or other mathematics courses?
11. What type of open collaboration is existent on Langston University's campus, with other faculty members of other departments and among yourselves, to improve or revise the mathematics curriculum to meet the needs of the students at Langston University?

STUDENT QUESTIONNAIRE II

Please circle one of the following:

Gender**A. male****B. female****Student****A. traditional****B. non-traditional****Race/ethnic group****A. Caucasian/White****B. African-American/Black****C. Asian American****D. Latino-Hispanic American****E. Native American**

Please answer the following questions by circling an answer.

1. *In which course are currently enrolled?*

A. College Algebra B. Trigonometry C. Neither

2. *How many times have you enrolled in either College Algebra or Trigonometry at Langston University?*

A. Once B. Twice C. Three or more

3. *How far did you go in the mathematics courses that were offered at your high school?*

A. Algebra I

B. Algebra I and II

C. Algebra I and II, and Geometry

D. Algebra I and II, Geometry, and Trigonometry

E. Algebra I and II, Geometry, Trigonometry, and Calculus

F. Other: (please specify) _____

4. *Does your college instructor use a variety of methods to teach College Algebra and Trigonometry?*

A. Yes B. No

If yes, please label the following methods from 1 to 8 with the number one being the method most often used.

- ☐ *Computer-assisted*
- ☐ *Hands-on projects*
- ☐ *Writing assignments*
- ☐ *Homework*
- ☐ *Student participation*
- ☐ *Lecture*
- ☐ *Audio-visual material(hand-outs, music, models, etc.)*
- ☐ *Question and Answer*

5. *Do you feel that your mathematics instructor teaches to a specific gender?*

A. Yes B. No

If so, which? A. Female B. Male

6. *Do you have a fear of mathematics?*

A. Yes B. No C. Somewhat

7. *If yes, which of the following reasons explain why you fear mathematics?*

- A. *General dislike for mathematics*
- B. *Lack of understanding*
- C. *Lack of concern for mathematical concepts*

8. *Does it appear as if college instructors show an interest in all students mastering College Algebra and Trigonometry concepts?*

A. Yes B. No

9. *If your answer to number eight is yes, please circle the degree of interest.*

- A. *Great interest*
- B. *Some interest*
- C. *Little interest*

10. *If your answer to eight is no, please circle a reason.*
- A. *Instructors are not concerned with students or mastering concepts or being successful in mathematics.*
 - B. *Instructors focus on completing the syllabus schedule.*
 - C. *Instructors cater to students who are comprehending the concepts and other materials and ignore those who are not comprehending.*
11. *Have basic mathematics skills enhanced your success in the area of College Algebra and Trigonometry?*
- A. Yes B. No
12. *Depending on whether your answer to question eleven is yes or no, please circle a reason that supports your choice.*
- A. *Provided building blocks to learn new mathematical concepts.*
 - B. *It made learning new concepts simple.*
 - C. *I did not learn enough basic skills for it to help me in higher math courses.*
 - D. *I do not understand how the relationship of applying basic skills to higher level mathematics courses make learning easier.*
13. *Do you use the math lab?*
- A. Yes B. No
14. *If you do not use the math lab please circle your main reason for not using this facility.*
- A. *Math lab hours conflict with schedule.*
 - B. *The math lab is not helpful in my higher math courses.*
 - C. *There are not enough tutors in the math lab.*

- D. *The math lab is a waste of time.*
- E. *I am not in need of math assistance.*
- F. *I am receiving assistance in math elsewhere.*
- G. *Other _____*

15. *Do you feel that the instructional strategies of teachers in College Algebra or Trigonometry can be improved?*

A. *Yes* B. *No*

16. *If your answer to question fifteen is yes, please check all that apply.*

- ☐ *Take time to cover the material*
- ☐ *Provide the relevant information during instruction to fit the need of students*
- ☐ *Have more teachers who have had methodology courses in mathematics instruction*
- ☐ *Lengthen math lab hours*
- ☐ *Give a variety of active student participation projects*
- ☐ *Update computer system in the mathematics lab*
- ☐ *Extend Trigonometry and College Algebra courses over more semesters*
- ☐ *Make the classes smaller*
- ☐ *Purchase textbooks that cater to variety of learning levels and techniques*
- ☐ *Require student/teacher conferences*
- ☐ *Have more tutors for higher level math courses*
- ☐ *Hire teachers who teach math that is appropriate for specific majors*

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